

PROJECT facts

DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY

oil recovery
PROGRAM

ADVANCED WATERFLOOD TECHNOLOGIES FOR THE SOONER UNIT, DENVER BASIN

Project Description

As part of DOE's effort to assist domestic oil and gas producers to increase oil and gas production, Diversified Operating Corporation is demonstrating the use of three-dimensional (3-D) seismic surveying and reservoir fluid and pressure studies to design optimal infill drilling patterns for cost-effective waterflooding of sandstone reservoirs in the Sooner Unit of the Denver Basin. Variations in rock type, thickness and continuity of the reservoir strata create isolated "pods" of oil that are commonly missed by normal waterflood recovery processes. Project researchers are using well-pressure testing and 3-D seismic data to provide detailed imaging of the strata that can help determine optimal infill drilling locations between existing wells.

Horizontal extensions from existing vertical wells were considered to contact some of the smaller reservoir compartments, but drilling problems prevented this approach. Instead, recompletion of existing wells and new vertical infill wells are being used.

The project is near completion. An injection well and two producers drilled for the project are accounting for nearly half of the current 500 barrels of oil per day produced by the Sooner Unit. Injection and production volumes and bottom-hole pressures will be monitored to assess the impact of the modified injection patterns that result from drilling or recompleting injection or production wells.

Workshops on the application of the seismic and reservoir modeling technologies are being provided for other Rocky Mountain operators. In 1996, project results, along with the results of four other Class 1 waterflood enhancement projects, will be presented to interested operators throughout the United States as part of a traveling workshop on the practical benefits of reservoir and data management, 3-D seismic surveying, and other reservoir characterization techniques.

Program Goal

The current rate of abandonment for U.S. domestic oil wells poses a severe threat to mature fields with marginal production. If access to the wells can be maintained, available and developing technologies can be applied to reduce operating costs and increase production, prolonging the economic life of the field and adding reserves to the nation's oil supply.

The Department of Energy is cofunding a series of Oil Recovery Field Demonstration Projects designed to apply specific technologies identified by industry as needed to overcome specific barriers to production in the nation's various oil-producing regions, such as the Sooner Unit's isolated oil compartments.

Diversified Operating's Sooner Unit project is designed to demonstrate the effective use of modern 3-D seismic surveying combined with state-of-the-art reservoir analysis and computer simulation to determine the optimal locations for new "infill" wells that can contact and produce these isolated sources of oil. The project's test wells have already produced an additional 5% of the original oil in place, and doubled field production to nearly 500 barrels per day. Diversified estimates that 730,000 barrels of additional oil will be produced at the Sooner Unit as a result of the technologies demonstrated in this project. This additional oil will provide an estimated \$1.7 million in direct local, state and federal revenue, in addition to jobs, increased sales of equipment and services.

PRIMARY PROJECT

PARTNER

**Diversified Operating
Company**
Denver, CO

FOSSIL ENERGY PROGRAM

**Oil Recovery Field
Demonstration**

MAIN SITE

Sooner Unit Field
Weld County, CO

TOTAL ESTIMATED COST

\$1.6 million

COST SHARING

DOE - \$0.8 million
Non-DOE - \$0.8 million

DE-FC22-93BC14954

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Project Benefits

Numerous waterfloods have been conducted in the Denver-Julesburg basin since 1956. Although the average recovery is 35% of the original oil in place, most fields in the vicinity of the Sooner Unit have produced significantly less. This low recovery is assumed to be caused by the highly compartmentalized nature of the reservoirs in this part of the basin. The Sooner Unit, under primary production and the waterflood initiated in 1989, had produced only 15% of the original oil in place at the start of this project. Since the start of the project an additional 5% of the original oil in place has been produced and production rates have been doubled, to about 500 barrels of oil per day.

The operator estimates that 730,000 barrels of additional oil will be produced at the Sooner unit as a result of the technologies demonstrated in this project. The public benefit of increased domestic production is significant; the additional oil from this project is estimated to provide over \$1.7 million in direct local, state and federal revenue in addition to jobs, increased sales of equipment and services, and indirect tax revenues.

The project has demonstrated that statistical analysis of 3-D seismic data combined with geologic and engineering studies can accurately define reservoir compartmentalization to guide drilling and completion of injection and production wells for economical recovery of oil bypassed by earlier conventional field development.

The 3-D seismic survey was the first conducted in Colorado; subsequently, the value of the costly technology for field development has been recognized by operators, leading to many additional 3-D surveys in the region.

CONTACT POINTS

Terry J. Cammon

Diversified Operating Corporation
Denver, CO

Phone: (303) 595-3957

FAX: (303) 595-0429

Edith C. Allison

U.S. Department of Energy
Bartlesville Project Office
Bartlesville, OK

Phone: (918) 337-4390

FAX: (918) 337-4418

e-mail: eallison@bpo.gov

Cost Profile (Dollars in Millions)

	Budget Period 1 10/21/92	05/31/93	Budget Period 2 07/31/95
Department of Energy*	\$0.3		\$0.5
Private Sector Partners	\$0.3		\$0.5

* Obligated Funding

Key Milestones

